



HAL
open science

Gender differences in the association between morbidity and mortality among middle-aged men and women.

Archana Singh-Manoux, Alice Guéguen, Jane E. Ferrie, Martin J. Shipley, Pekka Martikainen, Sébastien Bonenfant, Marcel Goldberg, Michael G. Marmot

► To cite this version:

Archana Singh-Manoux, Alice Guéguen, Jane E. Ferrie, Martin J. Shipley, Pekka Martikainen, et al.. Gender differences in the association between morbidity and mortality among middle-aged men and women.. American Journal of Public Health, 2008, 98 (12), pp.2251-7. 10.2105/AJPH.2006.107912 . inserm-00256953

HAL Id: inserm-00256953

<https://inserm.hal.science/inserm-00256953v1>

Submitted on 11 Apr 2011

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Gender paradox: does the association between morbidity and mortality differ in middle-aged men and women?

Archana Singh-Manoux, PhD*

Alice Guéguen, PhD

Jane Ferrie, PhD

Martin Shipley, MSc

Pekka Martikainen, PhD

Sébastien Bonenfant, MSc

Marcel Goldberg, MD, PhD

Michael Marmot, FRCP

*Corresponding author & address

INSERM, U687

HNSM, 14 rue du Val d'Osne

94415 Saint-Maurice Cédex, France

Tel: + 33 (0)1 45 18 38 63; Fax: + 33 (0)1 45 18 38 89

Email: Archana.Singh-Manoux@st-maurice.inserm.fr

Word count: abstract: 180; text: 3492

Abstract

Background: Gender paradox refers to higher morbidity but lower mortality in women. We examined gender differences in mortality, morbidity and the association between the two.

Methods: We examined self-rated health, longstanding illness, respiratory illness, self-reported and employer recorded sickness absence, self-reported and objectively assessed hypertension, self-reported and objectively assessed coronary heart disease (CHD) from the Whitehall II data, and self rated health and sickness absence from the Gazel study.

Participants were aged 35-55 at baseline and followed up over 17 years.

Results: Male mortality was higher in Whitehall II (HR=1.56; 95% CI=1.28-1.91) and the Gazel cohort (HR=1.99; CI=1.66-2.40). Female excess morbidity was observed for self-rated health, both measures of sickness absence, self-reported hypertension, and self-reported CHD in the Whitehall II data and for employer-recorded sickness absence in the Gazel data. Only self-reported sickness absence in the Whitehall II data was more strongly associated with mortality in men ($p=0.01$).

Conclusions: Mortality was lower in women but morbidity was not consistently higher. The lack of sex differences in the association between morbidity and mortality suggests that this is not a likely explanation for the gender paradox.

Introduction

In most regions of the world, life expectancy in women is higher than in men.^{1, 2} Men are said to be “more vulnerable from the beginning of life”,³ with mortality rates in men being higher than those in women throughout the lifespan.^{4, 5} Research in the 1970s and 1980s routinely showed higher morbidity in women; this discrepancy between morbidity and mortality rates is referred to as the ‘gender paradox’ in health.⁵⁻¹⁰ However, uniformity in the pattern of sex differences for all measures of morbidity has been questioned.¹¹ At older ages, there is some evidence to suggest that there are minimal gender differences in self-assessed health,¹² alongside substantially higher levels of disability in women.^{13, 14} The notion of ubiquitous male vulnerability is also challenged by research showing higher mortality in women following cardiac surgery.¹⁵⁻²¹

It remains unclear if the gender paradox is based on inferences from ecological correlations between morbidity and mortality or whether the discrepancies hold true at the individual level. Furthermore, multiple measures of morbidity, both subjective and objective measures, have rarely been examined in the same study. In this paper, our first aim is to test the hypothesis of greater morbidity among women by examining a range of objective and subjective measures of health in middle aged men and women. For three of the measures included, we were able to compare self-report against an ‘objective’ measure of the morbidity.

One explanation for the gender paradox links it to greater stoicism in men and a greater willingness in women to use health services, report health problems,^{5, 22, 23} and to factor in less serious ailments in response to global questions on health.²⁴ Although these explanations implicate slightly different mechanisms they all assume that women’s illnesses are less likely to kill them. More specifically, if women over-report minor health problems or report health problems at an earlier, more benign stage then the association between morbidity and mortality ought to be smaller in women compared to men. Thus, our second aim was to

examine the evidence for this discrepancy in the association between morbidity and mortality by examining a range of objective and subjective measures of morbidity. We use data from two cohorts, the Whitehall II study and the GAZEL Study, on employed men and women aged 30-55 at baseline.

Methods

Cohort 1: Whitehall II

The British Whitehall II study is based on 10,308 individuals (6,895 men and 3,413 women), aged 35-55 years, employed in 20 departments in London between 1985 and 1988 (Phase 1). Phase 1 involved a clinical examination and a self-administered questionnaire containing sections on demographic characteristics, health, lifestyle factors, work characteristics, social support and life events. Clinical examination included measures of blood pressure, anthropometry, biochemical measurements, neuroendocrine function, and sub clinical markers of cardiovascular disease. Subsequent phases of data collection have alternated between postal questionnaire alone (Phases 2 (1989-1990), 4 (1995-1996), and 6 (2001)) and postal questionnaire accompanied by a clinical examination (Phases 3 (1991-1993), 5 (1997-1999) and 7 (2003-2004)). Further details of the study are available elsewhere.²⁵ The University College London ethics committee approved the study.

Measures of morbidity: Morbidity measures are taken from baseline apart from measures of Coronary heart disease (CHD) where, for reasons of statistical power, they are taken as all coronary events occurring up to Phase 3 (1991-1994).

Self rated health was assessed with the question: “Over the last 12 months would you say your health has been - very good, good, average, poor or very poor”. The first three categories were combined to denote good health and the other two to denote poor health.

Long standing illness was assessed with the question: “Do you have any longstanding illness, disability or infirmity?”

Respiratory illness was assessed via the Medical Research Council’s questionnaire.²⁶

Sickness absence was a measure of whether the individual had taken a total of over 15 days of sick leave in the preceding year and was assessed in two non-mutually exclusive ways. The first was based on self reported sickness absence and the second was doctor-certified sickness absence obtained from the employer’s records.

Hypertension was defined in two overlapping ways. First, it was assessed with the following question: “Has a doctor ever told you that your blood pressure was above normal”. The second, a more ‘objective’ assessment, consisted of individuals who recorded systolic blood pressure ≥ 140 mm Hg or diastolic blood pressure that was ≥ 90 mm Hg²⁷ or who declared being “currently on antihypertensive” medication. Blood pressure was measured twice in the sitting position after 5 minutes rest with the Hawksley random-zero sphygmomanometer. The average of these two was taken to be the measured blood pressure.

CHD prevalence was ascertained for the period up to Phase 3 using two different measures. The first was an ‘objective’ measure based on clinically verified events and included fatal and non-fatal Myocardial infarction (MI) and definite angina. MI was defined as a coronary death (ICD 9 codes 410–414) or non-fatal MI verified in clinical records. Potential cases of non-fatal MI were ascertained by questionnaire items on chest pain,²⁸ and doctor's diagnosis of heart attack. Details of physician diagnoses and investigation results were sought from clinical records for all potential cases of MI. Twelve lead resting electrocardiograms were performed at Phases 1 and 3 (Siemens Mingorec) and assigned Minnesota codes.²⁹ Based on all available data (from questionnaires, study electrocardiograms, hospital acute ECGs and cardiac enzymes), non-fatal MI was defined following MONICA criteria.³⁰ Classification of MI was carried out blind to other study data, independently by two trained coders, with adjudication

by a third in the (rare) event of disagreement. Angina included participants who reported symptoms of angina,³¹ with corroboration in clinical records or abnormalities on a resting ECG, exercise ECG, or coronary angiogram. The other measure of CHD was based solely on self-reported MI, nitrate medication or Rose angina. Since some subjects had both self-reported and clinically verified CHD in the period up to Phase 3, these two measures overlap.

Covariates: The covariates were used to adjust for structural inequalities in health^{32, 33} and consisted of age (5-year categories), employment grade and marital status. Employment grade, a 6-level variable, was the British civil service grade of employment at Phase 1. People in different grades differ with respect to salary, social status and level of responsibility. Marital status was assessed by questionnaire and consisted of the following categories: married or cohabiting, never married, separated or divorced, and widowed.

Mortality: 10297 (99.9 percent) respondents were traced for mortality from the baseline through the national mortality register kept by the National Health Services Central Registry, by using the National Health Service identification number assigned to each British citizen. Mortality follow-up was available until 30th September, 2004; a mean of 17.1 years for the morbidity measures from Phase 1 and a mean of 11.8 years for CHD.

Cohort 2: GAZEL

The GAZEL cohort was established in 1989 and is comprised of employees of France's national gas and electricity company: Electricité de France-Gaz de France (EDF-GDF). At baseline, 20,625 (15,011 men and 5,614 women), aged 35-50, gave consent to participate in this study. The study design consists of an annual questionnaire used to collect data on health, lifestyle, individual, familial, social and occupational factors and life events. Various sources

within EDF-GDF provide additional data about Gazel participants. Further details of this study can be found elsewhere.³⁴

Measures of morbidity: Morbidity measures are taken from baseline (1989).

Self rated health was assessed with the question: “How would you judge the state of your general health?”, responses were on an 8-point scale, anchored by 1=‘very good’ and 8=‘very bad’. The first five categories were combined to denote good health and the other three to denote poor health.

Sickness absence was a measure of whether the individual had taken a total of over 15 days of sick leave in the preceding year, obtained from the employer’s records of doctor-certified sickness absence.

Covariates: Analyses were adjusted for age, employment grade and marital status (married or cohabiting, never married, separated or divorced, and widowed). Employment grade, an 8-level variable, was assessed via the French National Statistics Institute (INSEE (http://www.insee.fr/fr/nom_def_met/nomenclatures/prof_cat_soc/html/L03_N1.HTM)).

Mortality: Mortality follow-up was available until 14th November, 2005, a mean of 16.5 years. All participants were traced for mortality from the baseline through the EDF-GDF human resources department and the retirement fund services.

Statistical analysis

Sex differences in mortality were examined using Cox proportional hazards models and morbidity rates were examined using logistic regression models, adjusted for age, employment grade and marital status. The associations between measures of morbidity and all-cause mortality were assessed using Cox proportional hazards models separately in men

and women, adjusting for the potential confounders; age, employment grade and marital status. These associations were then compared between women and men in the combined population (men and women) using an interaction term between sex and the measure of morbidity in question. All P values are 2-tailed.

Results

Of the 10,308 **Whitehall II** participants at baseline, mortality data were available for 10,297 individuals. As of 30th of September 2004, 605 individuals (5.8% men and 6.0% women) had died. 10,259 (601 deaths) of these individuals had data on all three covariates (age, employment grade and marital status). As shown in Table 1, men were slightly younger than women ($p < 0.001$) and had a higher probability of death once adjustments were made for age, employment grade and marital status (HR = 1.56, 95% CI = 1.28-1.91). In the **Gazel** cohort, data on covariates and mortality were available for 20,531 individuals. Men in this cohort were older ($p < 0.0001$) and again had a higher probability of death after 16.5 years of follow up (HR = 1.99, 95% CI = 1.66-2.40).

The analyses for specific morbidities include slightly smaller numbers in both cohorts (see Table 2). Data on 'long-standing illness' in **Whitehall II** were missing on a significant proportion of the sample because this measure was not included in the version of the questionnaire completed by the first 2913 participants at Phase 1. The numbers in the analyses for each measure of morbidity, alongside the percentage of men and women reporting the morbidity, are presented in Table 2. In the **Whitehall II** cohort long standing illness (31.5% men and 32.3% women) was the most widely recorded morbidity and 'objectively' measured CHD (3.3% men and 2.5%) the least.

Comparison of the prevalence of morbidity between men and women are also shown in Table 2. In **Whitehall II** analyses adjusted for age, employment grade and marital status,

HAL author manuscript inserm-00256953, version 1

women have greater morbidity as measured by self-rated health (OR = 1.40, 95% CI = 1.13-1.72), self-reported sickness absence (OR = 1.71, 95% CI = 1.46-2.01), employer-recorded sickness absence (OR = 1.72, 95% CI = 1.47-2.00), self-reported hypertension (OR = 1.68, 95% CI = 1.48-1.92), and self-reported CHD (OR = 1.26, 95% CI = 1.05-1.52). In fully adjusted analyses women have lower rates of respiratory illness (OR = 0.70, 95% CI = 0.59-0.84), ‘objectively’ defined hypertension (OR = 0.60, 95% CI = 0.53-0.68), and ‘objectively’ defined CHD (OR = 0.39, 95% CI = 0.29-0.53). The **Gazel** women have a higher rate of employer-recorded sickness absence (OR = 2.23, 95% CI = 2.05-2.44) but not poorer self-rated health. The interaction term between age and sex was not significant in either cohort, suggesting that sex differences in the prevalence of morbidity did not differ by age.

Table 3 presents the association between measures of morbidity and subsequent mortality in the two cohorts separately in men and women. The first column of results presents the percent mortality in individuals who were sick compared to those who were not sick for each measure of morbidity. For example, 13.9% of men who declared their health to be poor at Phase 1 (1985-1988) had died in the follow-up period compared to 5.4 % of men who declared their health as being good. These results are then summed up in an age-adjusted hazards ratio in the subsequent column, which is then adjusted for employment grade and marital status. The p-values under the column ‘sex diff’ shows the results of an interaction term between sex and the measure of morbidity in order to assess whether the hazards ratios are significantly different in men and women for the specific measure of morbidity. The associations between the two case definitions of CHD in the **Whitehall II** study are based on deaths that occurred after Phase 3 (1991-1994): 496 in all (4.8% men and 5.0% women). In fully adjusted analyses in the **Whitehall II** data, the association between morbidity and mortality was significantly stronger in men ($p = 0.01$) only for self-reported sickness absence of greater than 15 days in a year.

Table 3 also shows the results for self-rated health and sickness absence in the **Gazel** cohort. The associations between these measures of morbidity and mortality were not significantly different in men and women.

Discussion

Gender differences in morbidity

Out of the 9 measures of morbidity examined in the Whitehall II study, female excess morbidity was observed for five measures (self-rated health, self-reported and employer-recorded sickness absence, self-reported hypertension, and self-reported CHD) and a male excess for three measures (respiratory illness, ‘objectively’ defined hypertension, and ‘objectively’ defined CHD); no sex differences were observed for long standing illness. In the Gazel data, female rates were higher for employer-recorded sickness absence but not for self-rated health. For three of the measures in the Whitehall II data we were able to compare self-reported and ‘objectively’ defined measures of morbidity: sickness absence, hypertension, and CHD. Out of these three measures, there is a contradiction between the prevalence of subjective and objective morbidity for hypertension and CHD but not for sickness absence. Thus, the objective measures for CHD and hypertension show a male excess and the subjective measures show a female excess. However, both measures of sickness absence show a female excess. In addition, some measures that were solely self-reported, long standing illness and respiratory disease in the Whitehall II study and self-rated health in the Gazel study, do not show a female excess.

The female excess in morbidity is often linked to illness behaviour and health reporting behaviour.^{5, 23, 24, 35} These behaviours have been hypothesised to occur as a result of childhood socialization and adult role expectation and obligation,²³ and suggest not only greater stoicism in men but also greater medicalization in women. Overall, our results show

some support for a female excess in morbidity. Discrepancies between objective and subjective measures of the same condition, here CHD and hypertension, suggest some female over-reporting. However, they might also imply that clinical investigation is pursued less vigorously in women leading to lower rates of objectively measured illness.

Gender differences in the association between morbidity and mortality

Men have higher rates of mortality in both the Whitehall II and the Gazel cohort. However, there were no gender differences in the association between morbidity and mortality except for self reported sickness absence in Whitehall II. Thus, a differential association between morbidity and mortality in men and women cannot be a valid explanation for the gender paradox. The results relating to sickness absence could be explained by the fact that it measures not only absence due to sickness but also time taken off to meet other demands. It is important to note that the association between self-reported health, the most subjective of the measures of morbidity examined, and subsequent mortality is not significantly different in men and women in either cohort. Thus, the conclusion that women are less stoical and factor in less serious ailments when assessing their own health is not supported by our results.

Since Nathanson's (1975) seminal paper on "the contradiction" between sex differences in morbidity and mortality,⁶ attempts have been made to explain the discrepancy in morbidity and mortality. Self-rated health is one health measure where this issue has been examined on individual data. Although a review of studies appeared to show a slightly stronger association between self-rated health and subsequent mortality in men,³⁶ more recent work suggests that women and men use different criteria to judge self-rated health and the differential effect on mortality is due to some chronic diseases having a stronger impact on mortality in men.³⁷ Our analyses on middle-aged men and women clearly show no sex

differences in the ability of self-rated health to predict mortality in either the Whitehall II or the Gazel cohort.

Sex differences in health can be due to differences in biological risks, in risks acquired through social roles and behaviours, in illness behaviour, in health reporting behaviour, and in differential health care access, treatment and use.^{3, 5, 35, 38} Our results support the view that for some measures of health there is a male excess and for others a female excess.¹⁴ Men appear to be more vulnerable to certain illnesses and women to others. Critically, despite the sex-specific excesses in morbidity, the association between morbidity and subsequent mortality is similar in men and women. In our data, there is evidence for male vulnerability, in terms of higher prevalence, to respiratory illness, hypertension, and CHD. However, our results do not allow us to conclude that this vulnerability extends to poor prognosis for these illnesses. The probability of death among men with objectively defined hypertension and CHD is higher than among women but not significantly higher. Thus, in our data there is little evidence for a sex-specific fatality rate.

Clearly, the probability of death for men in both cohorts is higher. It is likely that the excess mortality in men can be explained by a greater prevalence of diseases in men that then kill them. The two cohorts examined here are still underpowered to explore this further. Nevertheless, the results presented in this paper show that there are sex differences in the distribution of diseases rather than in their prognoses. Mortality from external causes has been shown to be higher in men,⁴ but this would not contribute to explaining the gender paradox as no morbidity needs to be present before death.

Methodological considerations

There is an obvious caveat to the results reported here. Data are drawn from occupational cohorts and need to be replicated in a general population sample. The mortality rates in both cohorts are lower than the general population. In France, the adult (15 to 60 years) mortality

rate per 1000 individuals for the year 2004 was 132 for men and 60 for women, the corresponding figure in Britain was 102 and 63.³⁹ Thus, our sample is clearly healthier. However, the fact that the results on associations between morbidity and mortality don't differ in the two cohorts is a mitigating factor. Besides cultural differences, these are also slightly different cohorts. Although they are both occupation-based, the work content of the participants is quite different in the two cohorts. The Whitehall II jobs are office-based while the Gazel participants are employees of the Gas and Electricity public utilities in France (EDF-GDF), with many manual workers, both skilled and unskilled. At baseline (1989), 14.8% of male and 29.1% of female Gazel participants were classified as being "unskilled" workers by their employer in a three level classification: unskilled workers, skilled workers and managers.³⁴ However, the two cohorts have many similarities: a similar hierarchical occupational structure, stable employment and similar social gradients in health and disease. An advantage to examining the gender paradox in occupational cohorts is that employment grade, a comprehensive measure of socioeconomic position in both cohorts, can be used as a covariate in the analyses. Women in both cohorts occupy lower socioeconomic position. The male disadvantage in mortality in both cohorts is accentuated when further adjustment is made for employment grade.

Conclusions

We found little evidence for sex differences in the association between morbidity and mortality leading us to conclude that this is not a valid explanation for the gender paradox. We observed male excess in mortality and some female excess in morbidity but in this group of middle aged women we found self reported measures of morbidity to predict mortality similarly in men and women. Thus, middle-aged women in both cohorts assessed their own health equally accurately. However, our results do not allow us to rule out completely the

existence of the gender paradox. It is possible that certain illnesses not examined in this study are equally or more prevalent in women but are more fatal for men.

A wide range of genetic, hormonal, social, and cultural factors are likely to play a role in shaping male and female patterns of morbidity and mortality. However, these forces need not influence male and female health in the same way, leading to gendered patterns of mortality and morbidity. Future work would benefit from an examination of the gender paradox in a younger and an older age group. The female health disadvantage is known to be largest at younger ages and smallest at older ages;^{13, 14} examination of the gender paradox at different ages would show whether age is an important moderator of this paradox. Finally, closer attention to cause-specific mortality when examining specific morbidities like CHD would also be helpful.

About the authors

A Singh-Manoux, A Guéguen, S Bonenfant & M Goldberg are with INSERM U687-IFR69. A Singh-Manoux, J Ferrie, M Shipley & M Marmot are with the Department of Epidemiology and Public Health, University College London, UK. P Martikainen is with the University of Helsinki, Finland. A Singh-Manoux is also with the Centre de Gérontologie, Hôpital Ste Péline, AP-HP.

Reprint requests should be sent to Archana Singh-Manoux, INSERM U687; HNSM, 14 rue du Val d'Osne, 94415 Saint-Maurice Cedex, France (email: Archana.Singh-Manoux@st-maurice.inserm.fr)

Contributors

AS-M generated the study hypothesis, carried out the analysis and wrote the first draft of the paper. All authors contributed to interpretation of results and revisions of the paper.

Human Participant Protection

Ethical approval for the Whitehall II Study was obtained from the University College London Medical School Committee on the ethics of human research. The GAZEL study was approved by the ethics review committee of l'Institut National de la Santé et de la Recherche Médicale (INSERM).

Acknowledgements

AS-M is supported by a “Chaire d'excellence” award from the French Ministry of Research and a “European Young Investigator Award” from the European Science Foundation. The Whitehall II study is supported by grants from the Medical Research Council; British Heart Foundation; Health and Safety Executive; Department of Health; National Heart Lung and Blood Institute (HL36310), US, NIH: National Institute on Aging, US, NIH; Agency for Health Care Policy Research (HS06516); and the John D and Catherine T MacArthur Foundation Research Networks on Successful Midlife Development and Socio-economic Status and Health. We thank all participating civil service departments and their welfare, personnel, and establishment officers; the Occupational Health and Safety Agency; the Council of Civil Service Unions; all participating civil servants in the Whitehall II study; and all members of the Whitehall II study team.

The Gazel cohort is supported by Electricité de France-Gaz de France (EDF-GDF). We would like to thank all the staff at INSERM 687.

Table 1: Sex differences in mortality in the Whitehall II and Gazel cohort.

WHITEHALL II	men	women
N	6871	3388
Age at Phase1 (1985-1988)	Mean = 44.0 (SD = 6.0)	Mean = 45.3 (SD = 6.1)
Deaths by 30/09/2004	398 (5.8%)	203 (6.0%)
Hazards Ratio (95% CI)	0.97 (0.82-1.15)	1
+ age	1.09 (0.92-1.29)	1
+ age, employment grade & marital status	1.56 (1.28-1.91)	1
GAZEL		
N	14955	5576
Age at Phase1 (1989)	Mean = 44.9 (SD = 2.9)	Mean = 42.2 (SD = 4.2)
Deaths by 14/11/2005	825 (5.5%)	149 (2.7%)
Hazards Ratio (95% CI)	2.10 (1.76-2.50)	1
+ age	1.73 (1.45-2.07)	1
+ age, employment grade & marital status	1.99 (1.66-2.40)	1

Table 2: Sex differences in the distribution of disease in the Whitehall II and Gazel cohort

WHITEHALL II	Sex (N)	ill %	OR (95% CI) adjusted for age	OR (95% CI) adjusted for age, employment grade & marital status
Self-rated health ¹	M (6846)	3.9	1	1
	F (3378)	7.4	1.97 (1.65-2.36)	1.40 (1.13-1.72)
Long standing illness	M (5142)	31.5	1	1
	F (2465)	32.3	0.99 (0.90-1.11)	0.92 (0.81-1.04)
Respiratory illness	M (6822)	8.4	1	1
	F (3338)	7.5	0.87 (0.74-1.01)	0.70 (0.59-0.84)
Sickness absence ² (self-report)	M (6734)	6.2	1	1
	F (3254)	16.0	2.81 (2.45-3.22)	1.71 (1.46-2.01)
Sickness absence ²	M (6271)	7.6	1	1
	F (2868)	21.1	3.13 (2.76-3.57)	1.72 (1.47-2.00)
Hypertension (self-report)	M (6652)	12.5	1	1
	F (3329)	21.7	1.86 (1.67-2.08)	1.68 (1.48-1.92)
Hypertension ³	M (6855)	20.6	1	1
	F (3386)	16.6	0.71 (0.63-0.79)	0.60 (0.53-0.68)
CHD (self-report)	M (6791)	6.1	1	1
	F (3337)	8.9	1.44 (1.23-1.68)	1.26 (1.05-1.52)
CHD	M (6791)	3.3	1	1
	F (3337)	2.5	0.62 (0.49-0.80)	0.39 (0.29-0.53)
GAZEL				
Self-rated health ¹	M (14829)	4.6	1	1
	F (5491)	4.9	1.25 (1.08-1.46)	1.09 (0.93-1.28)
Sickness absence ²	M (14955)	12.2	1	1
	F (5576)	23.8	2.39 (2.20-2.60)	2.23 (2.05-2.44)

¹Poor or very poor self rated health.

²More than 15 days of sick leave in the year.

³Systolic blood pressure greater than or equal to 140 or Diastolic blood pressure than or equal to 90 or on antihypertensive medication .

Table 3: Morbidity at Phase 1 (1985-1989) and subsequent mortality (till 30/09/2004) in men and women

	Sex	mortality (%) in those sick/not sick	HR (95% CI) (adjusted for age)	Sex diff [†]	HR (95% CI) (adjusted for age, grade, & marital status)	Sex diff [†]
Self-rated health ¹	M	13.9 / 5.4	2.72 (1.94-3.81)	p=.14	2.37 (1.68-3.34)	p=.26
	F	10.0 / 5.6	1.82 (1.20-2.77)		1.77 (1.16-2.68)	
Long standing illness	M	7.2 / 4.8	1.38 (1.09-1.75)	p=.32	1.32 (1.04-1.67)	p=.28
	F	8.2 / 4.5	1.71 (1.22-2.39)		1.71 (1.22-2.39)	
Respiratory illness	M	9.4 / 5.5	1.73 (1.30-2.30)	p=.77	1.63 (1.22-2.18)	p=.83
	F	9.2 / 5.7	1.61 (1.04-2.48)		1.57 (1.01-2.42)	
Sickness absence ² (self-report)	M	13.7 / 5.2	2.61 (1.97-3.46)	p=.003	2.26 (1.70-3.01)	p=.01
	F	7.9 / 5.4	1.32 (0.93-1.87)		1.24 (0.88-1.76)	
Sickness absence ²	M	9.2 / 5.4	1.72 (1.25-2.36)	p=.88	1.43 (1.03-1.98)	p=.52
	F	9.3 / 4.8	1.81 (1.31-2.50)		1.71 (1.23-2.37)	
Hypertension (self-report)	M	9.7 / 5.4	1.56 (1.22-1.99)	p=.10	1.42 (1.11-1.82)	p=.21
	F	6.8 / 5.8	1.11 (0.81-1.54)		1.13 (0.82-1.57)	
Hypertension ³	M	9.8 / 4.7	1.81 (1.47-2.32)	p=.09	1.75 (1.42-2.16)	p=.08
	F	9.1 / 5.3	1.33 (0.96-1.84)		1.31 (0.95-1.81)	
CHD (self-report)	M	9.7 / 4.5	1.84 (1.32-2.56)	p=.57	1.58 (1.02-2.43)	p=.67
	F	8.1 / 4.7	1.77 (1.27-2.47)		1.60 (1.04-2.48)	
CHD	M	14.4 / 4.4	2.35 (1.62-3.39)	p=.64	2.16 (1.49-3.14)	p=.72
	F	11.8 / 4.8	1.97 (1.04-3.74)		1.86 (0.98-3.54)	
GAZEL						
Self-rated health ¹	M	14.4 / 5.0	2.91 (2.36-3.60)	p=.73	2.63 (2.13-3.25)	p=.81
	F	6.7 / 2.4	2.64 (1.61-4.32)		2.53 (1.54-4.16)	
Sickness absence ²	M	9.9 / 4.9	2.05 (1.74-2.42)	p=.04	1.82 (1.54-2.16)	p=.08
	F	3.4 / 2.4	1.36 (0.96-1.94)		1.34 (0.94-1.92)	

[†] Results of an interaction term between sex and the measure of morbidity.

¹Poor or very poor self rated health.

²More than 15 days of sick leave in the year.

³Systolic blood pressure greater than or equal to 140 or Diastolic blood pressure than or equal to 90 or on medication for antihypertensive drugs.

References

Reference List

- (1) WHO. World Health Report 2000. Geneva: WHO; 2000.
- (2) Mathers CD, Sadana R, Salomon JA, Murray CJ, Lopez AD. Healthy life expectancy in 191 countries, 1999. *Lancet* 2001 May 26;357(9269):1685-91.
- (3) Kraemer S. The fragile male. *BMJ* 2000 December 23;321(7276):1609-12.
- (4) Owens IPF. Sex differences in mortality rates. *Science* 2002;297:2008-9.
- (5) Verbrugge LM, Wingard DL. Sex differentials in health and mortality. *Health Matrix* 1987;5(2):3-19.
- (6) Nathanson CA. Illness and the feminine role: a theoretical review. *Soc Sci Med* 1975 February;9(2):57-62.
- (7) Nathanson CA. Sex, illness, and medical care. A review of data, theory, and method. *Soc Sci Med* 1977 January;11(1):13-25.
- (8) Waldron I, Johnston S. Why do women live longer than men? *J Human Stress* 1976 June;2(2):19-30.
- (9) Waldron I. Sex differences in illness incidence, prognosis and mortality: issues and evidence. *Soc Sci Med* 1983;17(16):1107-23.
- (10) Verbrugge LM. Female illness rates and illness behavior: testing hypotheses about sex differences in health. *Women Health* 1979;4(1):61-79.
- (11) Hunt K, Annandale E. Relocating gender and morbidity: examining men's and women's health in contemporary Western societies. Introduction to Special Issue on Gender and Health. *Soc Sci Med* 1999 January;48(1):1-5.
- (12) Leinonen R, Heikkinen E, Jylha M. Self-rated health and self-assessed change in health in elderly men and women--a five-year longitudinal study. *Soc Sci Med* 1998 February;46(4-5):591-7.
- (13) Arber S, Cooper H. Gender differences in health in later life: the new paradox? *Soc Sci Med* 1999 January;48(1):61-76.
- (14) Macintyre S, Hunt K, Sweeting H. Gender differences in health: are things really as simple as they seem? *Soc Sci Med* 1996 February;42(4):617-24.
- (15) Andrikopoulos GK, Tzeis SE, Pipilis AG et al. Younger age potentiates post myocardial infarction survival disadvantage of women. *Int J Cardiol* 2006 April 14;108(3):320-5.
- (16) Blankstein R, Ward RP, Arnsdorf M, Jones B, Lou YB, Pine M. Female gender is an independent predictor of operative mortality after coronary artery bypass graft surgery: contemporary analysis of 31 Midwestern hospitals. *Circulation* 2005 August 30;112(9 Suppl):I323-I327.

- HAL author manuscript inserm-00256953, version 1
- (17) Guru V, Fremes SE, Tu JV. Time-related mortality for women after coronary artery bypass graft surgery: a population-based study. *J Thorac Cardiovasc Surg* 2004 April;127(4):1158-65.
 - (18) Hogue CW, Jr., Barzilai B, Pieper KS et al. Sex differences in neurological outcomes and mortality after cardiac surgery: a society of thoracic surgery national database report. *Circulation* 2001 May 1;103(17):2133-7.
 - (19) Koch CG, Khandwala F, Nussmeier N, Blackstone EH. Gender and outcomes after coronary artery bypass grafting: a propensity-matched comparison. *J Thorac Cardiovasc Surg* 2003 December;126(6):2032-43.
 - (20) Lansky AJ, Pietras C, Costa RA et al. Gender differences in outcomes after primary angioplasty versus primary stenting with and without abciximab for acute myocardial infarction: results of the Controlled Abciximab and Device Investigation to Lower Late Angioplasty Complications (CADILLAC) trial. *Circulation* 2005 April 5;111(13):1611-8.
 - (21) Vaccarino V, Horwitz RI, Meehan TP, Petrillo MK, Radford MJ, Krumholz HM. Sex differences in mortality after myocardial infarction: evidence for a sex-age interaction. *Arch Intern Med* 1998 October 12;158(18):2054-62.
 - (22) Verbrugge LM. Sex differentials in health. *Public Health Rep* 1982 September;97(5):417-37.
 - (23) Hibbard JH, Pope CR. Another look at sex differences in the use of medical care: illness orientation and the types of morbidities for which services are used. *Women Health* 1986;11(2):21-36.
 - (24) Spiers N, Jagger C, Clarke M, Arthur A. Are gender differences in the relationship between self-rated health and mortality enduring? Results from three birth cohorts in Melton Mowbray, United Kingdom. *Gerontologist* 2003 June;43(3):406-11.
 - (25) Marmot M, Brunner E. Cohort Profile: the Whitehall II study. *Int J Epidemiol* 2005 April;34(2):251-6.
 - (26) Medical Research Council. Definition and classification of chronic bronchitis for epidemiological purposes. *Lancet* 1965;i:775-9.
 - (27) Chobanian AV, Bakris GL, Black HR et al. The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure: the JNC 7 report. *JAMA* 2003 May 21;289(19):2560-72.
 - (28) Rose GA, Blavkburn H, Gillium RF, Prineas RJ. *Cardiovascular survey methods*. 2nd ed. Geneva: 1982.
 - (29) Prineas RJ, Crown RS, Blackburn H. *The Minnesota Code Manual of Electrocardiographic findings: Standards and procedures for measurement and classification*. Bristol, UK: John Wright; 1982.
 - (30) Tunstall-Pedoe H, Kuulasmaa K, Amouyel P, Arveiler D, Rajakangas AM, Pajak A. Myocardial infarction and coronary deaths in the World Health Organization

MONICA Project. Registration procedures, event rates, and case-fatality rates in 38 populations from 21 countries in four continents. *Circulation* 1994 July;90(1):583-612.

- (31) Rose G, Hamilton PS, Keen H, Reid DD, McCartney P, Jarrett RJ. Myocardial ischaemia, risk factors and death from coronary heart-disease. *Lancet* 1977 January 15;1(8003):105-9.
- (32) Arber S. Class, paid employment and family roles: making sense of structural disadvantage, gender and health status. *Soc Sci Med* 1991;32(4):425-36.
- (33) Macran S, Clarke L, Joshi H. Women's health: dimensions and differentials. *Soc Sci Med* 1996 May;42(9):1203-16.
- (34) Goldberg M, Chastang JF, Leclerc A et al. Socioeconomic, demographic, occupational, and health factors associated with participation in a long-term epidemiologic survey: a prospective study of the French GAZEL cohort and its target population. *Am J Epidemiol* 2001 August 15;154(4):373-84.
- (35) Verbrugge LM. The twain meet: empirical explanations of sex differences in health and mortality. *J Health Soc Behav* 1989 September;30(3):282-304.
- (36) Idler EL, Benyamini Y. Self-rated health and mortality: a review of twenty-seven community studies. *J Health Soc Behav* 1997 March;38(1):21-37.
- (37) Case A, Paxson C. Sex differences in morbidity and mortality. *Demography* 2005 May;42(2):189-214.
- (38) Denton M, Prus S, Walters V. Gender differences in health: a Canadian study of the psychosocial, structural and behavioural determinants of health. *Soc Sci Med* 2004 June;58(12):2585-600.
- (39) World Health Statistics 2006. World Health Organization . 2006.
Ref Type: Internet Communication